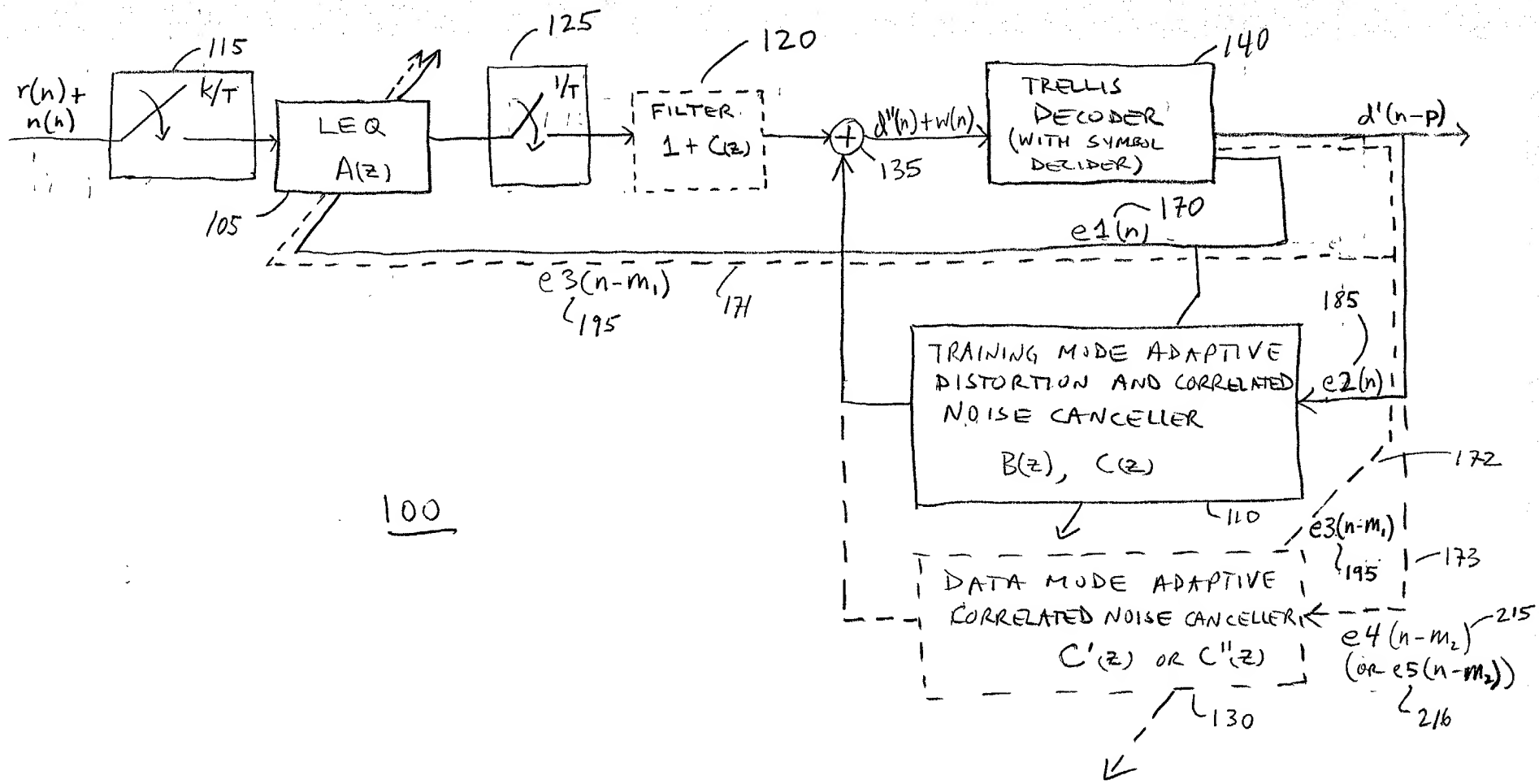
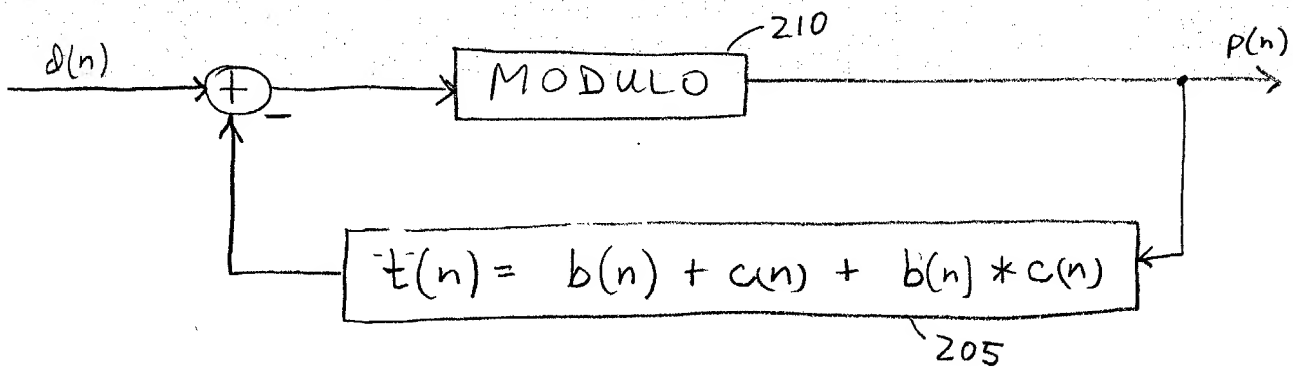

r(n)+ n(n)
115
k/T
LEQ A(z)
105
125
1/T
FILTER 1 + C(z)
120
d''(n)+w(n)
135
TRELLIS DECODER (WITH SYMBOL DECIDER)
140
d'(n-p)
e1(n)
170
e3(n-m1)
195
171
185
TRAINING MODE ADAPTIVE DISTORTION AND CORRELATED NOISE CANCELLER
B(z), C(z)
e2(n)
172
110
100
e3(n-m1)
195
173
DATA MODE ADAPTIVE CORRELATED NOISE CANCELLER
C'(z) OR C''(z)
e4(n-m2)
(OR e5(n-m2))
215
216
130

FIG 1



200

FIG. 2

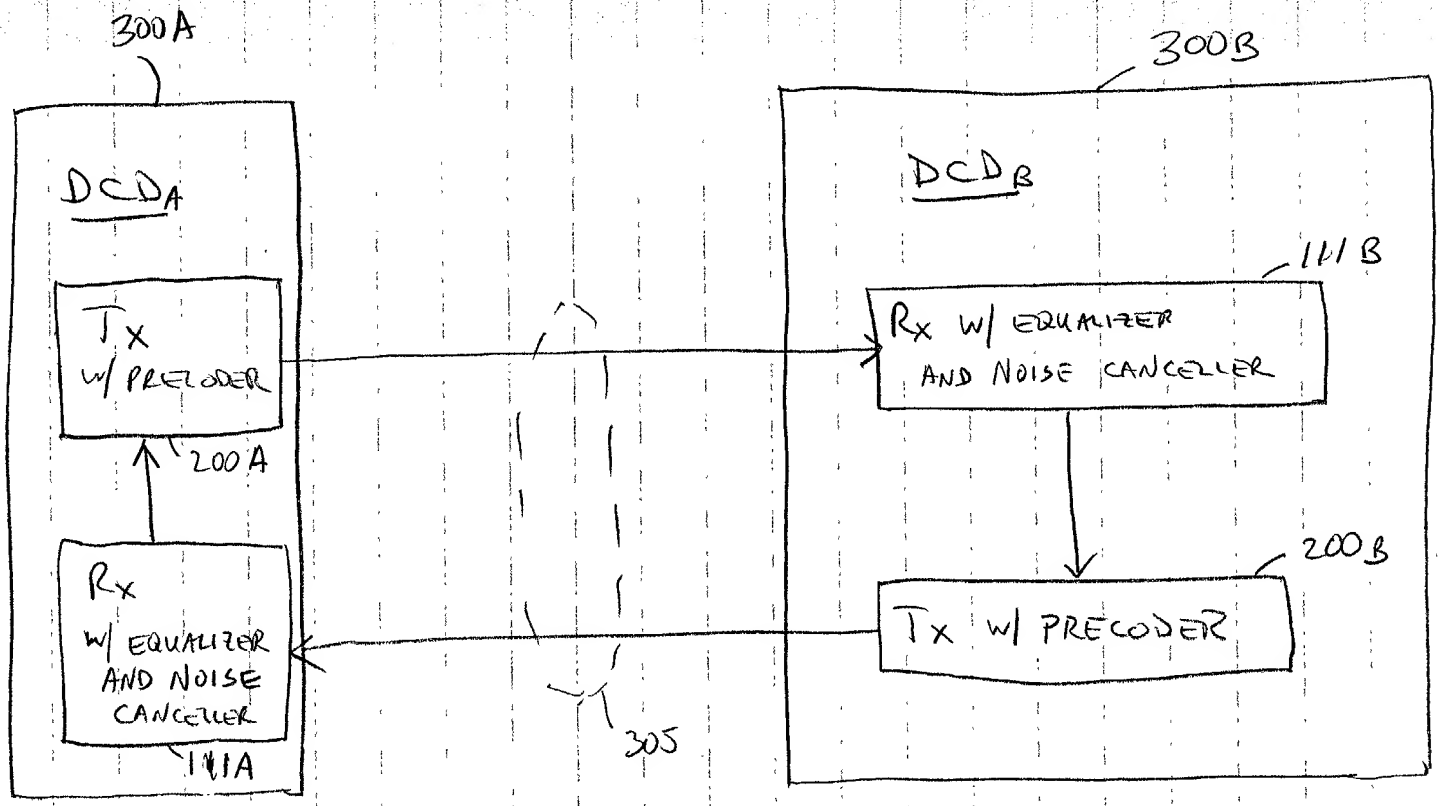

300A
DCD_A
Tx
W/ PRECODER
200A
Rx
W/ EQUALIZER
AND NOISE
CANCELLER
111A
300B
DCD_B
111B
Rx W/ EQUALIZER
AND NOISE CANCELLER
200B
Tx W/ PRECODER
305

FIG. 3

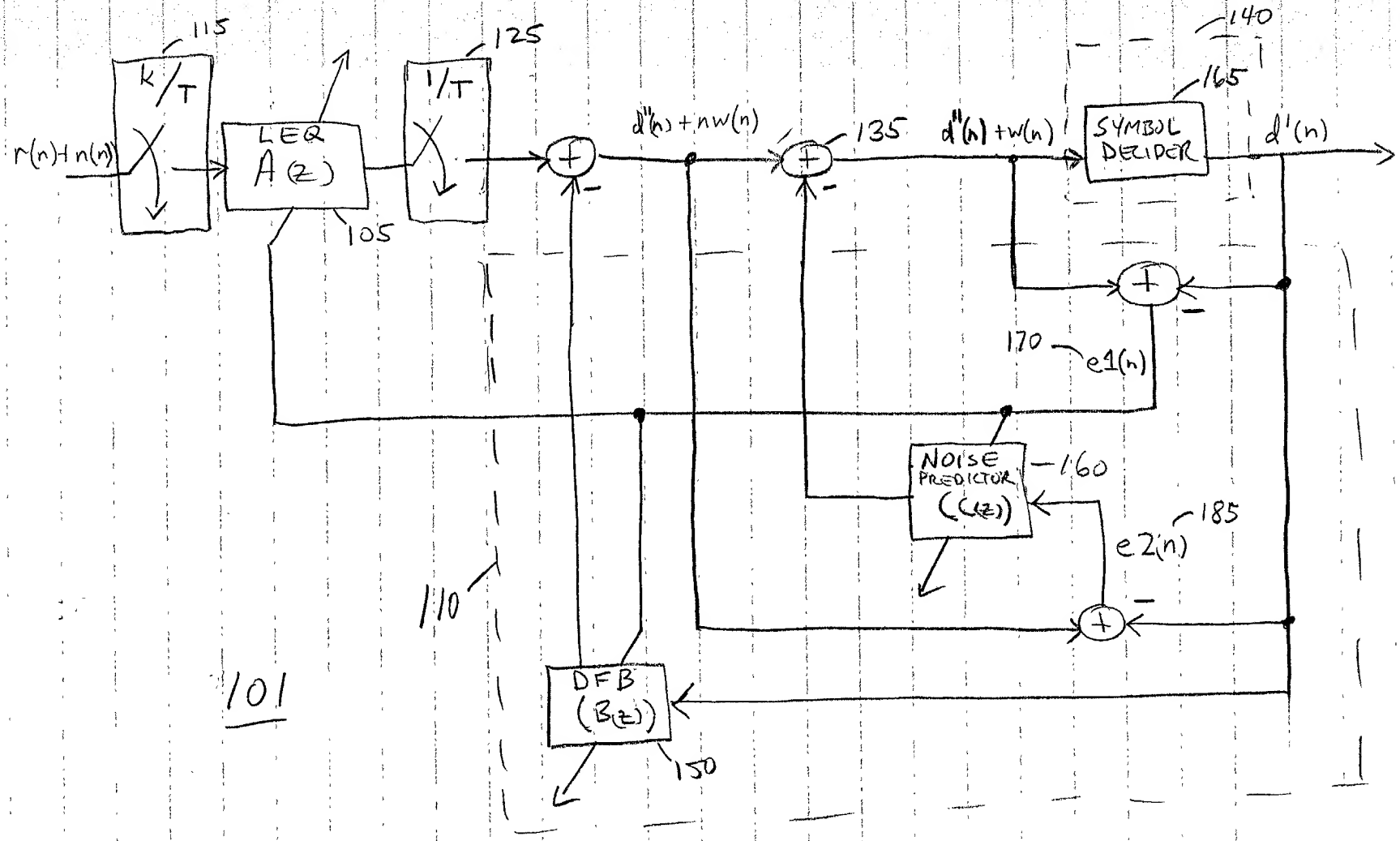
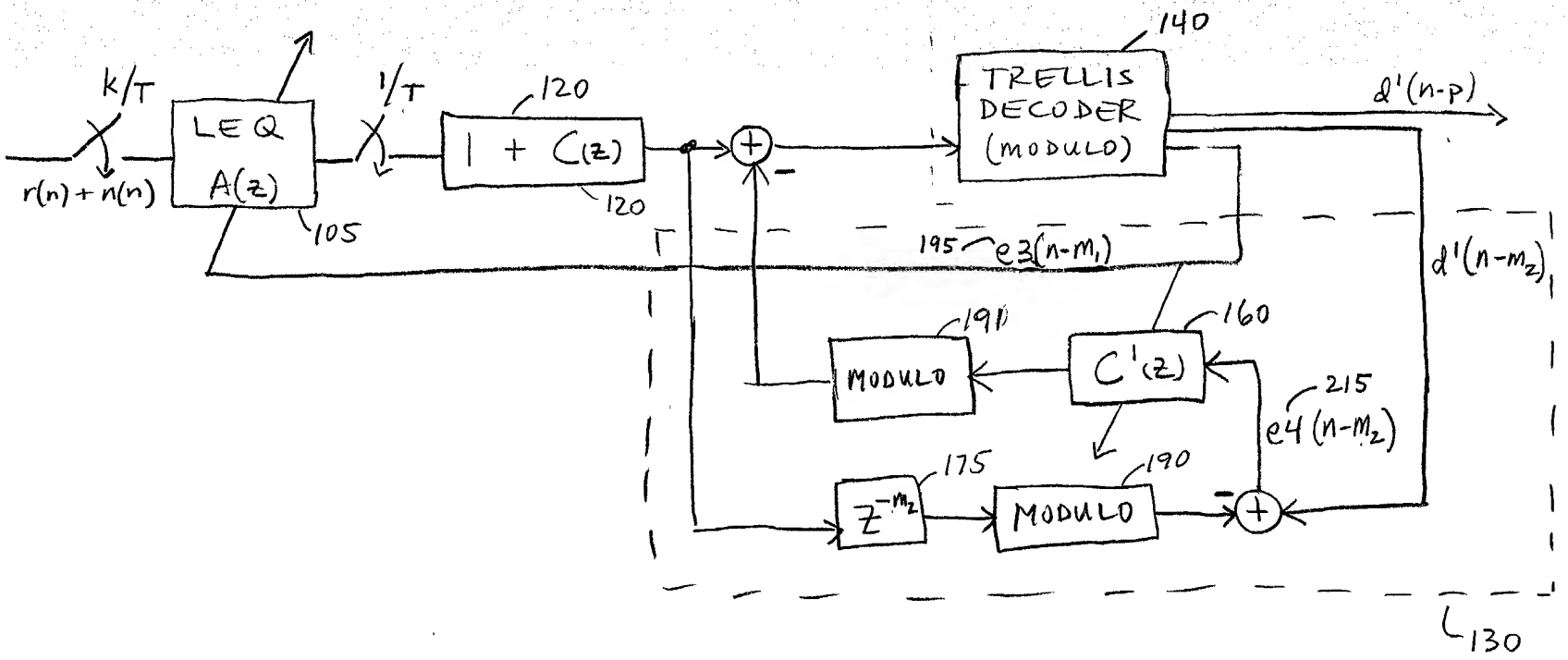

115
k/T
r(n)+n(n)
LEQ
A(z)
105
125
1/T
d''(n)+nw(n)
135
d''(n)+w(n)
140
SYMBOL DECIDER
165
d'(n)
170
e1(n)
NOISE PREDICTOR
(C(z))
160
e2(n)
185
110
101
DFB
(B(z))
150

FIG. 4


k/T
LEQ
A(z)
105
r(n) + n(n)
1/T
120
1 + C(z)
120
140
TRELLIS
DECODER
(MODULO)
d'(n-p)
195
e3(n-M1)
d'(n-M2)
191
MODULO
160
C'(z)
215
e4(n-M2)
175
Z^-M2
190
MODULO
130

102

FIG. 5

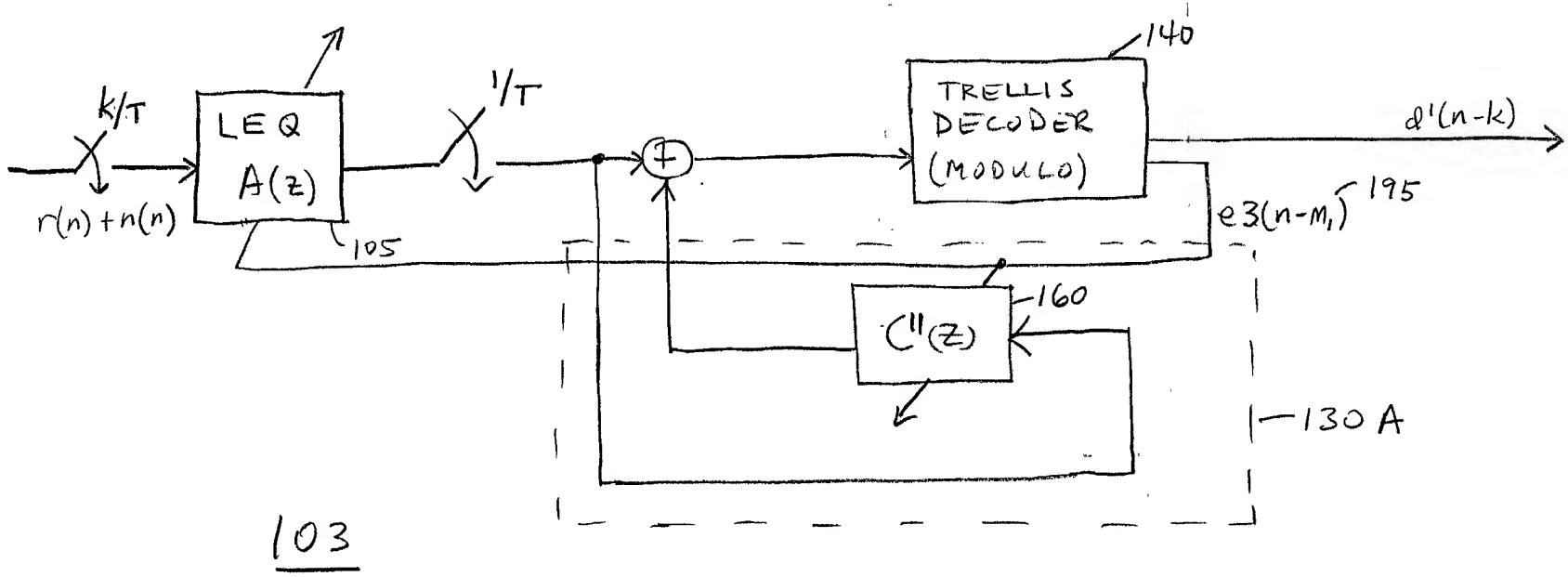

k/T
LEQ
A(z)
1/T
r(n)+n(n)
105
140
TRELLIS
DECODER
(MODULO)
d'(n-k)
e3(n-m1)
195
C''(z)
160
130A
103

FIG. 6

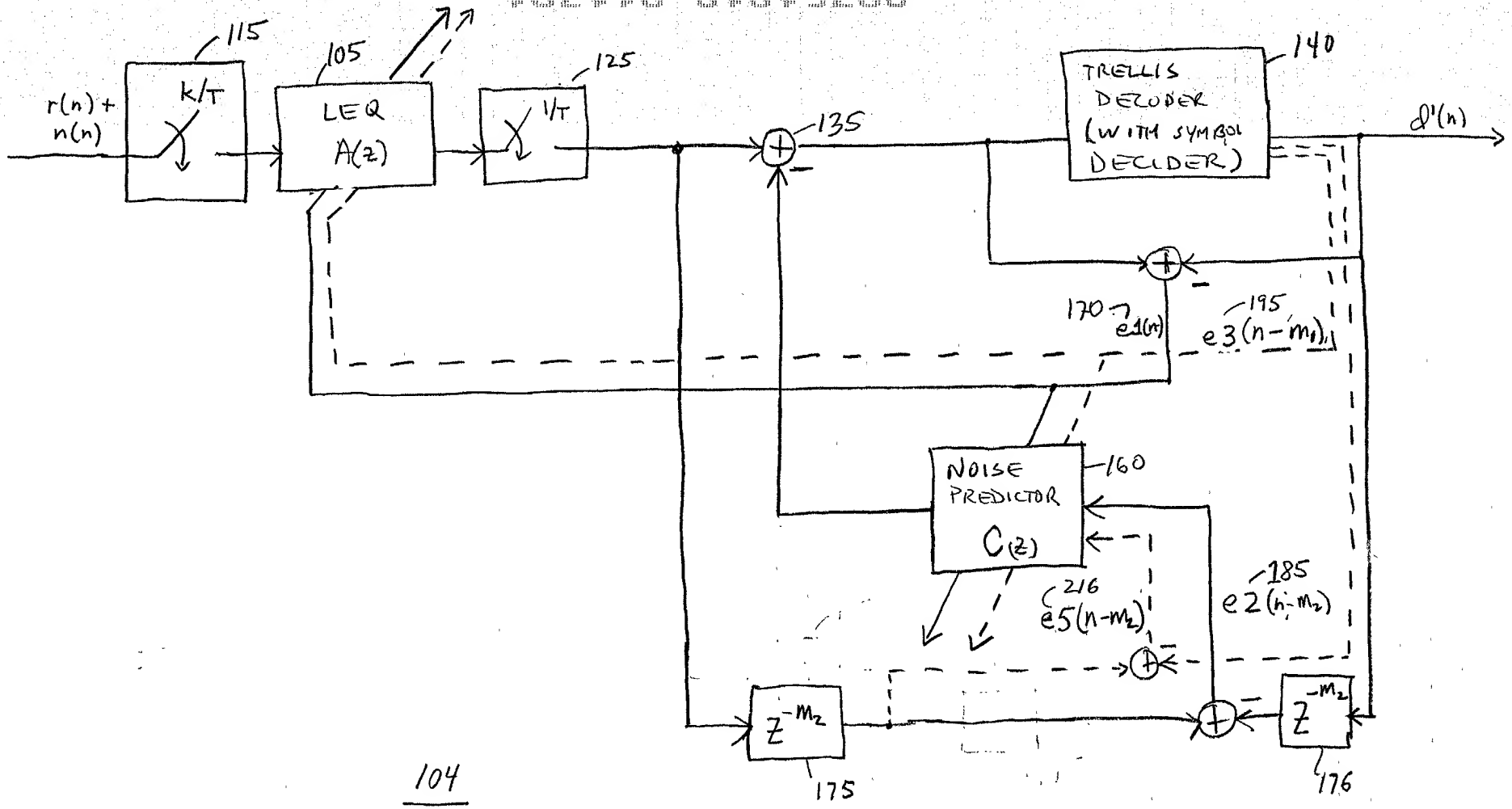

r(n) + n(n)
k/T
115
LEQ A(z)
105
1/T
125
135
TRELLIS DECODER (WITH SYMBOL DECIDER)
140
d'(n)
170
e1(n)
195
e3(n-m1)
NOISE PREDICTOR C(z)
160
216
e5(n-m2)
185
e2(n-m2)
Z^-m2
175
Z^-m2
176
104

FIG. 7

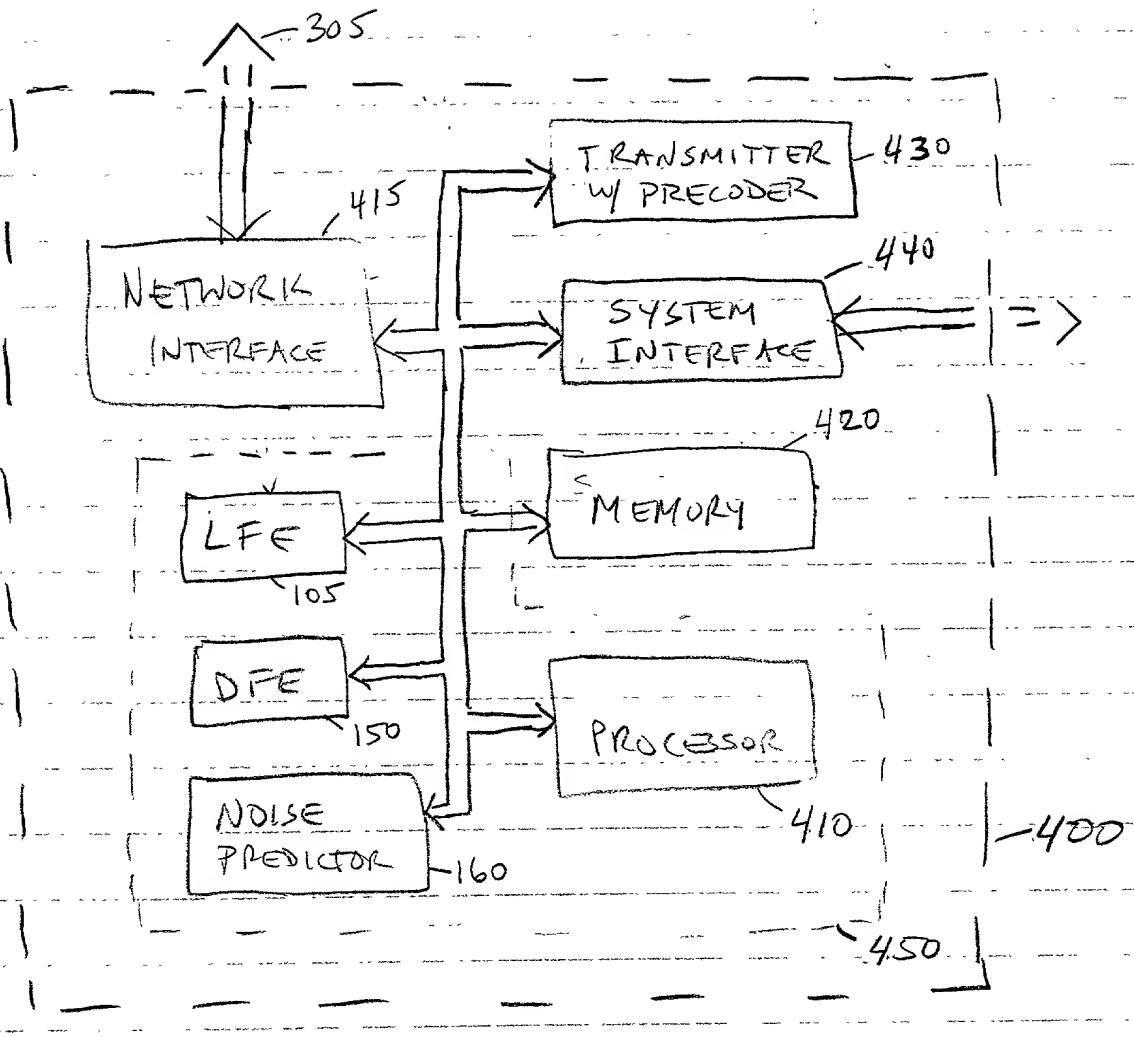
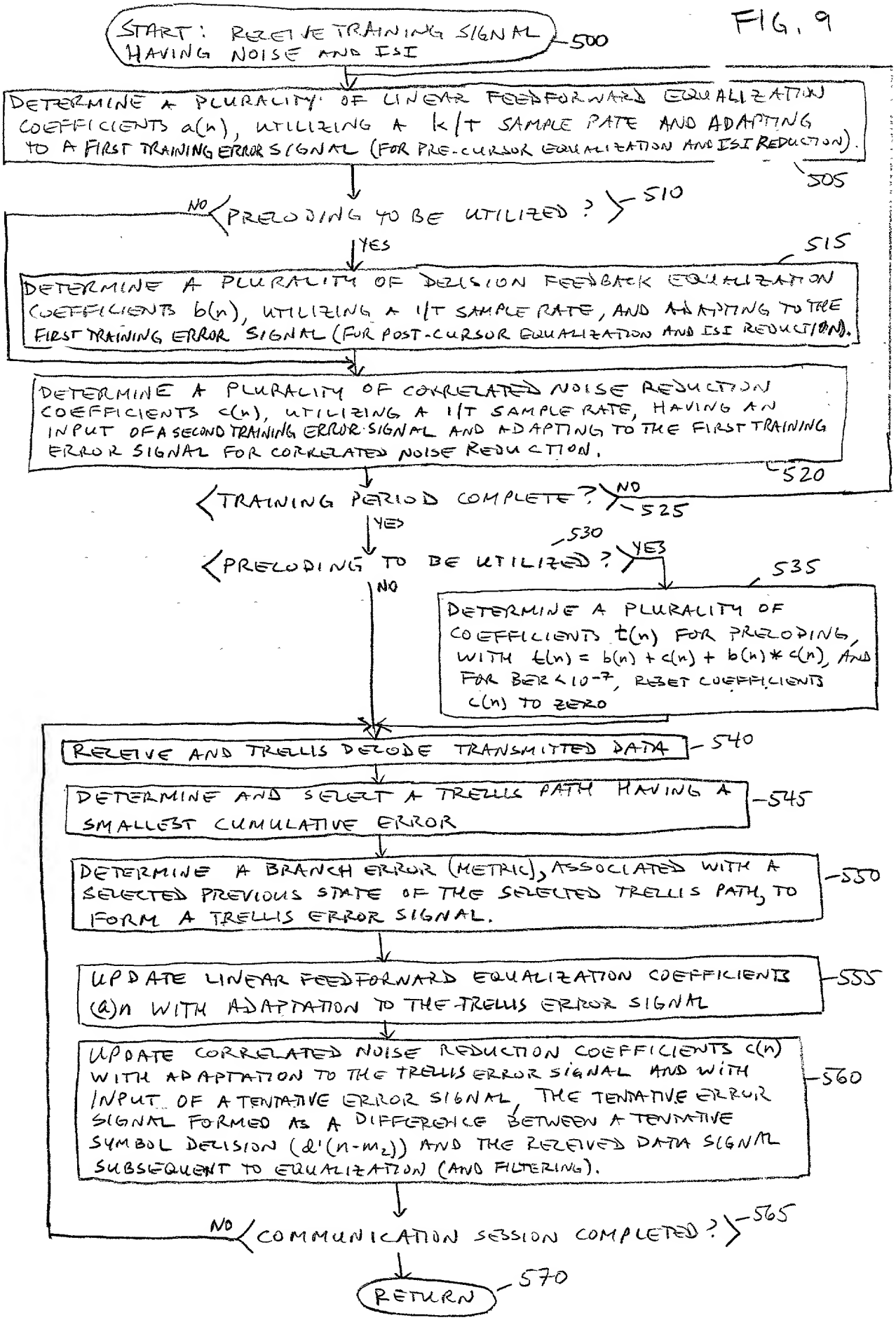

305
TRANSMITTER W/ PRECODER
430
415
NETWORK INTERFACE
440
SYSTEM INTERFACE
=>
420
MEMORY
LFE
105
DFE
150
PROCESSOR
410
400
NOISE PREDICTOR
160
450

FIG 8

FIG. 9


START: RECEIVE TRAINING SIGNAL HAVING NOISE AND ISI
500
DETERMINE A PLURALITY OF LINEAR FEEDFORWARD EQUALIZATION COEFFICIENTS a(n), UTILIZING A k/T SAMPLE RATE AND ADAPTING TO A FIRST TRAINING ERROR SIGNAL (FOR PRE-CURSOR EQUALIZATION AND ISI REDUCTION).
505
PRELOADING TO BE UTILIZED?
510
NO
YES
DETERMINE A PLURALITY OF DECISION FEEDBACK EQUALIZATION COEFFICIENTS b(n), UTILIZING A 1/T SAMPLE RATE, AND ADAPTING TO THE FIRST TRAINING ERROR SIGNAL (FOR POST-CURSOR EQUALIZATION AND ISI REDUCTION).
515
DETERMINE A PLURALITY OF CORRELATED NOISE REDUCTION COEFFICIENTS c(n), UTILIZING A 1/T SAMPLE RATE, HAVING AN INPUT OF A SECOND TRAINING ERROR SIGNAL AND ADAPTING TO THE FIRST TRAINING ERROR SIGNAL FOR CORRELATED NOISE REDUCTION.
520
TRAINING PERIOD COMPLETE?
525
NO
YES
PRELOADING TO BE UTILIZED?
530
YES
NO
DETERMINE A PLURALITY OF COEFFICIENTS t(n) FOR PRELOADING, WITH t(n) = b(n) + c(n) + b(n) * c(n), AND FOR BER < 10^-7, RESET COEFFICIENTS c(n) TO ZERO
535
RECEIVE AND TRELLIS DECODE TRANSMITTED DATA
540
DETERMINE AND SELECT A TRELLIS PATH HAVING A SMALLEST CUMULATIVE ERROR
545
DETERMINE A BRANCH ERROR (METRIC), ASSOCIATED WITH A SELECTED PREVIOUS STATE OF THE SELECTED TRELLIS PATH, TO FORM A TRELLIS ERROR SIGNAL.
550
UPDATE LINEAR FEEDFORWARD EQUALIZATION COEFFICIENTS a(n) WITH ADAPTATION TO THE TRELLIS ERROR SIGNAL
555
UPDATE CORRELATED NOISE REDUCTION COEFFICIENTS c(n) WITH ADAPTATION TO THE TRELLIS ERROR SIGNAL AND WITH INPUT OF A TENTATIVE ERROR SIGNAL, THE TENTATIVE ERROR SIGNAL FORMED AS A DIFFERENCE BETWEEN A TENTATIVE SYMBOL DECISION (d'(n-M2)) AND THE RECEIVED DATA SIGNAL SUBSEQUENT TO EQUALIZATION (AND FILTERING).
560
COMMUNICATION SESSION COMPLETED?
565
NO
RETURN
570

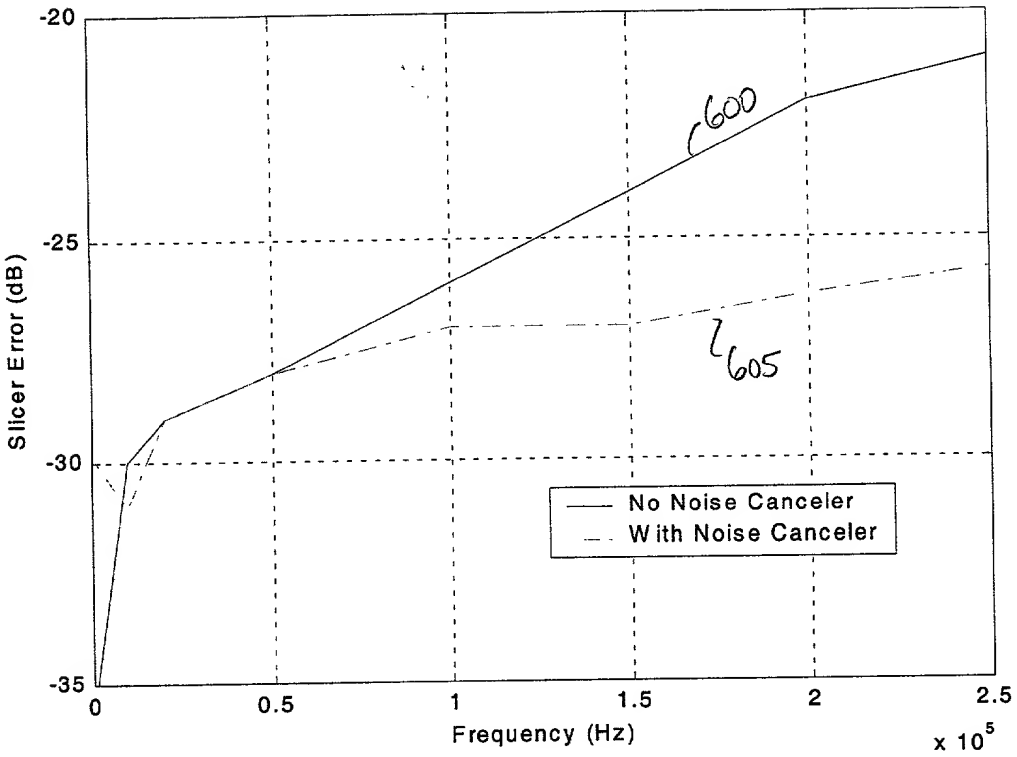

-20
-25
-30
-35
Slicer Error (dB)
0
0.5
1
1.5
2
2.5
Frequency (Hz)
x 10^5
600
605
No Noise Canceler
With Noise Canceler

Figure 10

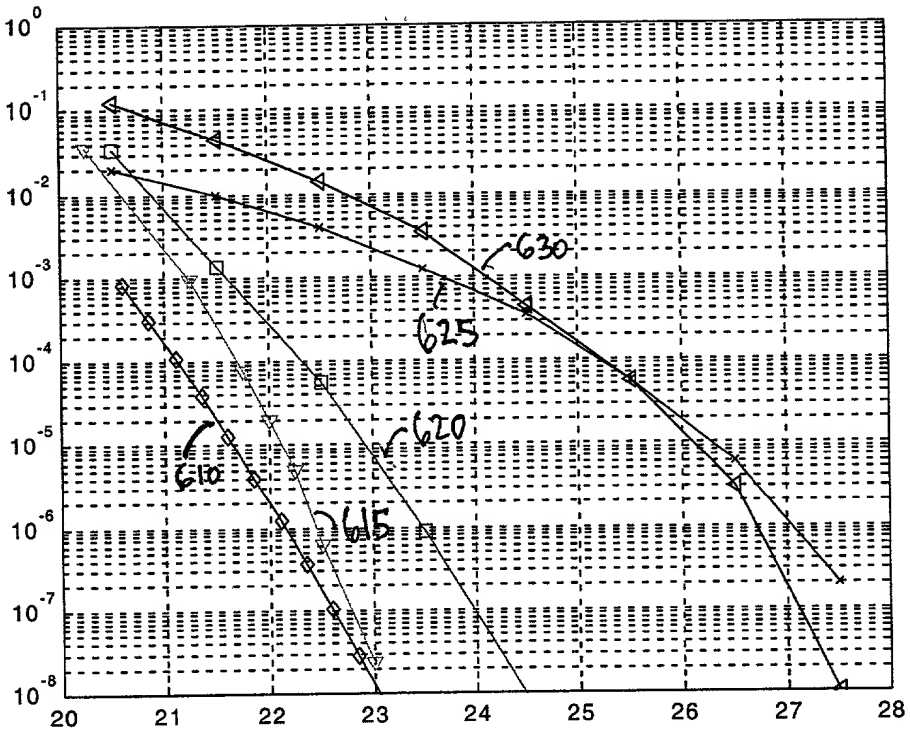

10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
20
21
22
23
24
25
26
27
28
630
625
620
610
645

Figure 11

720 Crosstalk Environment	735 Correlation Canceller Improved Performance Margin(dB)
700 24T1+24 HDSL2 (C)	1.4
705 39 HDSL2 (C)	1.5
710 24 ADSL+24 HDSL(C)	1.8
715 24 T1+24 HDSL2 (R)	1.4

Figure 12